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Supplemental Data

Sex-Averaged Recombination and Mutation Rates on the X Chromosome: A Comment on Labuda et al. (2010)

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Appendix S1. Correction of the Equations in Appendix A of Labuda et al. (2010):

Genetic Diversity of the X Chromosome and the Autosomes

The sex-averaged X chromosome mutation rate (μ_X) does not depend on the sex-ratio of the population and has been shown to be $\mu_X = (2\mu_f + \mu_m)/3$, where μ_f and μ_m are the female and male mutation rates, respectively. This expression accounts for the fact that each X chromosome spends 2/3 of its time in females. Importantly, the above expression differs from that used to calculate the sex-averaged recombination rate ($r_X = (2/3)r_{fX}$) since mutation, unlike recombination, can occur in males.

Given the expression for μ_X, the population-scaled mutation rate for the X chromosome Θ_X can be found from the expression

$$\Theta_X = 4N_{eX}\frac{2\mu_f + \mu_m}{3} \quad . \qquad \text{(Equation A2)}$$

Then, the ratio between genetic diversity on the X chromsome and the autosomes does depend on the ratio of breeding females and males in the population β, and is written as

$$\frac{\Theta_X}{\Theta_A} = \frac{2}{3}\left(\frac{9\beta+9}{8\beta+16}\right)\left(\frac{2\mu_f + \mu_m}{\mu_f + \mu_m}\right). \qquad \text{(Equation A3)}$$

If we define $\alpha = \mu_m / \mu_f$, then Equation A3 can be re-written as

$$\frac{\Theta_X}{\Theta_A} = \frac{2}{3}\left(\frac{9\beta+9}{8\beta+16}\right)\left(\frac{2+\alpha}{1+\alpha}\right). \qquad \text{(Equation A4)}$$

Labuda et al. (2010) then use estimates of Θ_X / Θ_A and β to estimate α. The correct expression is

$$\alpha = \frac{4\frac{\Theta_X}{\Theta_A}(\beta+2)-6(\beta+1)}{3(\beta+1)-4\frac{\Theta_X}{\Theta_A}(\beta+2)}. \qquad \text{(Equation A5)}$$

If α were known, it could be used to estimate β by

$$\beta = \frac{8\frac{\Theta_X}{\Theta_A}(\alpha+1)-3(\alpha+2)}{3(\alpha+2)-4\frac{\Theta_X}{\Theta_A}(\alpha+1)}. \qquad \text{(Equation A6)}$$

Figure S1: Ratio of X to Autosome Genetic Diversity (Θ_X/Θ_A) as a Function of the Breeding Ratio (β) in the Population for Different Values of α

The curves in this figure are from the corrected Equation A5 (see Appendix S1).